Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method for operating a servo system including a first member and a second member that is positionable relative to the ~~said~~ first member ~~in response to position signals~~, the method comprising ~~the steps of~~:

generating a position error signal to cause the ~~said~~ second member to be positioned at a desired location relative to the ~~said~~ first member; and

reducing a position error in the position error signal by non-linear attenuation, wherein the position error is due to a disturbance in the servo system, the disturbance generates a disturbance signal in the position error signal, reducing the position error includes selectively adjusting the disturbance signal as a function of the amplitude of the disturbance signal and the function has a first selectable parameter *N* representing a threshold level for non-linear signal level adjustment such that adjusting the disturbance signal is a non-linear function of the ratio of the amplitude of the disturbance signal and the parameter *N*.

2-4. (Cancelled)

5. (Currently Amended) The method of claim 1, ~~4,~~ wherein the ~~said~~ function ~~further~~ has a second selectable parameter M representing a signal adjustment ~~adjusting~~ factor.

6. (Currently Amended) The method of claim 5, wherein the ~~said~~ function is a cubic function.

7. (Currently Amended) The method of claim 6, wherein the ~~said~~ function is ~~represented as~~:

$$f(u) = M\left(\frac{u}{N}\right)^3,$$

~~wherein~~ u represents the amplitude of the disturbance signal ~~input~~.

8. (Currently Amended) The method of claim 7, ~~1,~~ wherein the function selectively amplifies or attenuates the disturbance signal depending on the ratio u/N~~:~~

~~a disturbance in the servo system generates a disturbance signal in the position signal; and~~

~~the step of reducing the position error further includes the steps of selectively adjusting the disturbance signal as a non-linear function of the magnitude of the disturbance signal, such that attenuation of the disturbance signal increases as a non-linear function of the magnitude of the disturbance signal~~.

9. (Currently Amended) The method of claim 1, ~~2,~~ wherein the ~~said~~ function is an odd function.

10. (Currently Amended) The method of claim 1, including~~wherein a disturbance in the servo system generates a disturbance signal in the position signal, and the method further comprising the steps of~~:

filtering the position error signal to selectively pass the disturbance signal;

generating a correction signal having an amplitude ~~a magnitude~~ that varies as a non-linear function of the amplitude ~~magnitude~~ of the disturbance signal; and

combining the correction signal with the position error signal to generate a corrected position error signal ~~with a disturbance signal that is adjusted as a non-linear function of the level of the disturbance signal~~, thereby reducing the position error in the position error signal.

11. (Currently Amended) The method of claim 10, wherein ~~the step of~~ filtering the position error signal includes~~further comprises the steps of~~ :

~~determining the frequency band of the disturbance signal; and~~

~~filtering the position signal to selectively pass the disturbance signal~~.

12. (Currently Amended) The method of claim 11, wherein ~~the step of~~ filtering the position error signal includes ~~the steps of filtering the position signal~~ using a peak filter based on the frequency band of the disturbance signal.

13. (Currently Amended) The method of claim 10, wherein ~~further the step of~~ filtering the position error signal includes ~~the steps of~~:

determining the frequency band and amplitude ~~magnitude~~ range of the disturbance signal; and

filtering the position error signal using a peak filter based on the frequency band and amplitude ~~magnitude~~ range of the disturbance signal ~~to selectively pass the disturbance signal~~.

14. (Currently Amended) The method of claim 10, wherein ~~the step of generating the correction signal further includes generating the correction signal such that~~ the amplitude ~~magnitude~~ of the correction signal increases as a non-linear function of the amplitude ~~magnitude~~ of the disturbance signal.

15. (Currently Amended) A servo system comprising:

a first member;

a second member positionable relative to the ~~said~~ first member ~~in response to position signals~~; and

a control loop including:

a servo controller that generates a position error signal ~~coupled to said second member~~ to cause the ~~said~~ second member to be positioned at a desired location relative to the ~~said~~ first member; and

an attenuator that selectively reduces a position error in the position error signal by non-linear filtering, wherein the position error is due to a disturbance in the servo system, the disturbance generates a disturbance signal in the position error signal, the attenuator includes a gain controller that adjusts the disturbance signal as a non-linear

function of the amplitude of the disturbance signal and the function has a first selectable parameter *N* representing a threshold level for non-linear signal level adjustment such that the gain controller adjusts the disturbance signal as a non-linear function of the ratio of the amplitude of the disturbance signal and the parameter *N*.

16-18. (Cancelled)

19. (Currently Amended) The servo system of claim 15, ~~18,~~ wherein the ~~said~~ function ~~in the gain controller further~~ has a second selectable parameter *M* representing ~~*M* representing~~ a signal adjustment factor.

20. (Currently Amended) The servo system of claim 19, wherein the ~~said~~ function ~~in the gain controller~~ is a cubic function.

21. (Currently Amended) The servo system of claim 20, wherein the ~~said~~ function ~~in the gain controller is represented as~~:

$$f(u) = M\left(\frac{u}{N}\right)^3,$$

~~wherein~~ *u* represents the amplitude of the disturbance signal.

22. (Currently Amended) The servo system of claim 21, ~~15,~~ wherein the function selectively amplifies or attenuates the disturbance signal depending on the ratio *u/N*~~gain controller adjusts a disturbance signal such that reduction of the position error increases as a non-linear function of the magnitude of the disturbance signal~~.

23. (Currently Amended) The servo system of claim 15, ~~16,~~ wherein the ~~said~~ function ~~in the gain controller~~ is an odd function.

24. (Currently Amended) The servo system of claim 15, wherein the attenuator includes:

a filter that filters the position error signal to selectively pass the ~~a~~ disturbance signal;

a gain controller that generates a correction signal having an amplitude ~~a magnitude~~ that varies as a non-linear function of the amplitude ~~magnitude~~ of the disturbance signal; and

a combiner that combines the correction signal with the position error signal to generate a corrected position error signal ~~with an adjusted disturbance signal~~.

25. (Currently Amended) The servo system of claim 24, wherein the filter is ~~comprises~~ a band pass filter.

26. (Currently Amended) The servo system of claim 24, wherein the filter is ~~comprises~~ a peak filter ~~selected~~ based on the frequency band of the disturbance signal.

27. (Currently Amended) The servo system of claim 24, wherein the filter is ~~comprises~~ a peak filter ~~selected~~ based on the frequency band and amplitude ~~magnitude~~ range of the disturbance signal ~~to selectively pass the disturbance signal~~.

28. (Currently Amended) The servo system of claim 24, wherein the amplitude ~~magnitude~~ of the correction signal increases as a non-linear function of the amplitude ~~magnitude~~ of the disturbance signal.

29. (Currently Amended) The servo system of claim 24, wherein:

the position error signal includes multiple peaks at different frequencies; and

the attenuator includes:

a first filter that filters the position error signal to selectively pass a first disturbance signal at a first peak frequency;

a first gain controller that generates a first correction signal having an amplitude ~~a magnitude~~ that varies as a non-linear function of the amplitude ~~magnitude~~ of the ~~said~~ first disturbance signal ~~signal at the first peak frequency~~;

a second filter that filters the position error signal to selectively pass a second disturbance signal at a second peak frequency;

a second gain controller that generates a second correction signal having an amplitude ~~a magnitude~~ that varies as a non-linear function of the amplitude ~~magnitude~~ of the ~~said~~ second disturbance signal ~~signal at the second peak frequency~~; and

a combiner that combines the first and ~~and/or~~ the second correction signals with the position error signal to generate a corrected position error signal ~~with adjusted disturbance signals~~, ~~to~~ thereby reducing the ~~reduce~~ position error ~~errors~~ in the position error signal.

30. (Currently Amended) The servo system of claim 24, wherein the attenuator includes ~~further comprises:~~

~~———~~a saturation controller ~~filter~~ that limits the corrected position error signal ~~output of the attenuator~~ to preserve servo loop ~~servo loop~~ stability as the correction signal ~~gain controller output~~ increases above a threshold.

31. (Currently Amended)The servo system of claim 24, wherein the attenuator includes ~~further comprises:~~

~~———~~a deadzone controller that filters the corrected position error signal ~~output of the attenuator~~ to preserve servo loop ~~servo loop~~ stability as the correction signal ~~gain controller output~~ decreases below a threshold.

32. (Currently Amended) A disk drive comprising:

a disk for storing information ~~content~~ in tracks;

a transducer ~~structure~~ positionable over ~~one of~~ the ~~said~~ tracks for reading ~~said~~ information ~~content~~ therefrom; and

a control loop including:

a servo controller that generates a position error signal ~~coupled to said transducer structure~~ to cause the ~~said~~ transducer ~~structure~~ to be positioned relative to ~~at~~ a desired track on the disk; and

an attenuator that selectively reduces a position error in the position error signal by non-linear attenuation, wherein the position error is due to a disturbance in the disk drive, the disturbance generates a disturbance signal in the position error signal, the

attenuator includes a gain controller that adjusts the disturbance signal as a non-linear function of the amplitude of the disturbance signal and the function has a first selectable parameter *N* representing a threshold level for non-linear signal adjustment such that the gain controller adjusts the disturbance signal as a non-linear function of the ratio of the amplitude of the disturbance signal and the parameter *N*.

33-35. (Cancelled)

36. (Currently Amended) The disk drive of claim 32, ~~35,~~ wherein the ~~said~~ function ~~in the gain controller further~~ has a second selectable parameter *M* representing ~~*M* representing~~ a signal adjustment factor.

37. (Currently Amended) The disk drive of claim 36, wherein the ~~said~~ function ~~in the gain controller~~ is a cubic function.

38. (Currently Amended) The disk drive of claim 37, wherein the ~~said~~ function ~~in the gain controller~~ is ~~represented as~~:

$$f(u) = M\left(\frac{u}{N}\right)^3,$$

~~wherein~~ *u* represents the amplitude of the disturbance signal ~~input~~.

39. (Currently Amended) The disk drive of claim 38, ~~32,~~ wherein the function selectively amplifies or attenuates the disturbance signal depending on the ratio *u/N*~~gain~~

~~controller adjusts the disturbance signal such that adjustment of the disturbance signal increases as a non-linear function of the magnitude of the disturbance signal~~.

40. (Currently Amended) The disk drive of claim 32, ~~33,~~ wherein the ~~said~~ function ~~in the gain controller~~ is an odd function.

41. (Currently Amended) The disk drive of claim 32, wherein the attenuator includes:

a filter that filters the position error signal to selectively pass the disturbance signal;

a gain controller that generates a correction signal having an amplitude ~~a magnitude~~ that varies as a non-linear function of the amplitude ~~magnitude~~ of the ~~a~~ disturbance signal ~~in the position signal~~; and

a combiner that combines the correction signal with the position error signal to generate a corrected position error signal ~~with a selectively and non-linearly adjusted disturbance signal~~.

42. (Currently Amended) The disk drive of claim 41, wherein the filter is ~~comprises~~ a band pass filter.

43. (Currently Amended) The disk drive of claim 41, wherein the filter is ~~comprises~~ a peak filter ~~selected~~ based on the frequency band of the disturbance signal.

44. (Currently Amended) The disk drive of claim 41, wherein the filter is ~~comprises~~ a peak filter ~~selected~~ based on the frequency band and amplitude ~~magnitude~~ range of the disturbance signal ~~to selectively pass the disturbance signal~~.

45. (Currently Amended) The disk drive of claim 41, wherein the amplitude ~~magnitude~~ of the correction signal increases as a non-linear function of the amplitude ~~magnitude~~ of the disturbance signal.

46. (New) The disk drive of claim 41, wherein the attenuator includes a saturation controller that limits the corrected position error signal to preserve servo loop stability as the correction signal increases above a threshold.

47. (New)The disk drive of claim 41, wherein the attenuator includes a deadzone controller that filters the output signal of the attenuator to preserve servo loop stability as the gain controller output signal decreases below a threshold.

48. (New) The disk drive of claim 41, wherein the attenuator includes:

a saturation controller that limits the corrected position error signal to preserve servo loop stability as the correction signal increases above a threshold; and

a deadzone controller that filters the output signal of the attenuator to preserve servo loop stability as the gain controller output signal decreases below a threshold.

49. (New) The disk drive of claim 32, wherein the disturbance is a random disturbance.

50. (New) The disk drive of claim 49, wherein the random disturbance is non-repeatable run out.

51. (New) The disk drive of claim 50, wherein the non-repeatable run out is due to a rocking mode excited by a spindle motor bearing.

52. (New) A method for operating a servo system including a first member and a second member that is positionable relative to the first member, the method comprising:

generating a position error signal to cause the second member to be positioned at a desired location relative to the first member; and

reducing a position error in the position error signal by non-linear attenuation, wherein the position error is due to a disturbance in the servo system, the disturbance generates a disturbance signal in the position error signal and reducing the position error includes selectively adjusting the disturbance signal as an odd function of the amplitude of the disturbance signal.

53. (New) A method for operating a servo system including a first member and a second member that is positionable relative to the first member, the method comprising:

generating a position error signal to cause the second member to be positioned at a desired location relative to the first member;

reducing a position error in the position error signal by non-linear attenuation, wherein the position error is due to a disturbance in the servo system and the disturbance generates a disturbance signal in the position error signal;

determining the frequency band and amplitude range of the disturbance signal;

filtering the position error signal using a peak filter based on the frequency band and amplitude range of the disturbance signal to selectively pass the disturbance signal;

generating a correction signal having an amplitude that varies as a non-linear function of the amplitude of the disturbance signal; and

combining the correction signal with the position error signal to generate a corrected position error signal, thereby reducing the position error in the position error signal.

54. (New) A servo system comprising:

a first member;

a second member positionable relative to the first member; and

a control loop including:

a servo controller that generates a position error signal to cause the second member to be positioned at a desired location relative to the first member; and

an attenuator that selectively reduces a position error in the position error signal by non-linear filtering, wherein the position error is due to a disturbance in the servo system, the disturbance generates a disturbance signal in the position error signal and the attenuator includes a gain controller that adjusts the disturbance signal as a non-linear odd function of the amplitude of the disturbance signal.

55. (New) A servo system comprising:

a first member;

a second member positionable relative to the first member; and

a control loop including:

a servo controller that generates a position error signal to cause the second member to be positioned at a desired location relative to the first member; and

an attenuator that selectively reduces a position error in the position error signal by non-linear filtering, wherein the position error is due to a disturbance in the servo system, the disturbance generates a disturbance signal in the position error signal and the attenuator includes:

a peak filter that filters the position error signal based on the frequency band and amplitude range of the disturbance signal to selectively pass the disturbance signal;

a gain controller that generates a correction signal having an amplitude that varies as a non-linear function of the amplitude of the disturbance signal; and

a combiner that combines the correction signal with the position error signal to generate a corrected position error signal.

56. (New) A servo system comprising:

a first member;

a second member positionable relative to the first member; and

a control loop including:

a servo controller that generates a position error signal to cause the second member to be positioned at a desired location relative to the first member; and

an attenuator that selectively reduces a position error in the position error signal by non-linear filtering, wherein the position error is due to a disturbance in the servo system, the disturbance generates a disturbance signal in the position error signal and the attenuator includes:

a filter that filters the position error signal to selectively pass the disturbance signal;

a gain controller that generates a correction signal having an amplitude that varies as a non-linear function of the amplitude of the disturbance signal;

a combiner that combines the correction signal with the position error signal to generate a corrected position error signal; and

a saturation controller that limits the corrected position error signal to preserve servo loop stability as the correction signal increases above a threshold.

57. (New) A servo system comprising:

a first member;

a second member positionable relative to the first member; and

a control loop including:

a servo controller that generates a position error signal to cause the second member to be positioned at a desired location relative to the first member; and

an attenuator that selectively reduces a position error in the position error signal by non-linear filtering, wherein the position error is due to a disturbance in the

servo system, the disturbance generates a disturbance signal in the position error signal and the attenuator includes:

a filter that filters the position error signal to selectively pass the disturbance signal;

a gain controller that generates a correction signal having an amplitude that varies as a non-linear function of the amplitude of the disturbance signal;

a combiner that combines the correction signal with the position error signal to generate a corrected position error signal; and

a deadzone controller that filters the output signal of the attenuator to preserve servo loop stability as the gain controller output signal decreases below a threshold.

58. (New) A disk drive comprising:

a disk for storing information in tracks;

a transducer positionable over the tracks for reading information therefrom; and

a control loop including:

a servo controller that generates a position error signal to cause the transducer to be positioned relative to a desired track on the disk; and

an attenuator that selectively reduces a position error in the position error signal by non-linear attenuation, wherein the position error is due to a disturbance in the disk drive, the disturbance generates a disturbance signal in the position error signal and the attenuator includes a gain controller that adjusts the disturbance signal as a non-linear odd function of the amplitude of the disturbance signal.

59. (New) A disk drive comprising:

a disk for storing information in tracks;

a transducer positionable over the tracks for reading information therefrom; and

a control loop including:

a servo controller that generates a position error signal to cause the transducer to be positioned relative to a desired track on the disk; and

an attenuator that selectively reduces a position error in the position error signal by non-linear attenuation, wherein the position error is due to a disturbance in the disk drive, the disturbance generates a disturbance signal in the position error signal and the attenuator includes:

a peak filter that filters the position error signal based on the frequency band and amplitude range of the disturbance signal to selectively pass the disturbance signal;

a gain controller that generates a correction signal having an amplitude that varies as a non-linear function of the amplitude of the disturbance signal; and

a combiner that combines the correction signal with the position error signal to generate a corrected position error signal.

60. (New) A disk drive comprising:

a disk;

a transducer for reading from and writing to the disk;

a servo controller that generates a position error signal that includes a disturbance signal, wherein the disturbance signal is due to a disturbance and causes a position error in the position error signal; and

an attenuator that includes a band pass filter, a gain controller and a combiner, wherein the band pass filter generates the disturbance signal by narrow-band filtering the position error signal, the gain controller generates a correction signal by applying a non-linear function to the disturbance signal, the function has a first selectable parameter *N* representing a threshold level for non-linear signal adjustment to adjust the disturbance signal as a non-linear function of the ratio of the amplitude of the disturbance signal and the parameter *N*, the combiner generates a corrected position error signal by summing the position error signal and the correction signal, the corrected position error signal has less of the position error than the position error signal has and the transducer is positioned relative to the disk by the corrected position error signal.

61. (New) The disk drive of claim 60, wherein the attenuator includes a saturation controller that clips the correction signal if the amplitude of the correction signal is above a threshold.

62. (New) The disk drive of claim 60, wherein the attenuator includes a deadzone controller that blocks the correction signal if the amplitude of the correction signal is below a threshold.

63. (New) The disk drive of claim 60, wherein the attenuator generates the correction signal in response to the servo controller entering on-track mode.

64. (New) The disk drive of claim 60, wherein the function is an odd function.

65. (New) The disk drive of claim 64, wherein the function is a cubic function.

66. (New) The disk drive of claim 65, wherein the function is:

$$f(u) = M\left(\frac{u}{N}\right)^3$$

M represents a signal adjustment factor; and

u represents the amplitude of the disturbance signal.

67. (New) The disk drive of claim 60, wherein the disturbance is a random disturbance.

68. (New) The disk drive of claim 67, wherein the random disturbance is non-repeatable run out.

69. (New) The disk drive of claim 68, wherein the non-repeatable run out is due to a rocking mode excited by a spindle motor bearing.

70. (New) A disk drive comprising:

a disk;

a transducer for reading from and writing to the disk;

a servo controller that generates a position error signal that includes a disturbance signal, wherein the disturbance signal is due to a disturbance and causes a position error in the position error signal; and

an attenuator that includes a band pass filter, a gain controller and a combiner, wherein the band pass filter generates the disturbance signal by narrow-band filtering the position error signal, the gain controller generates a correction signal by applying a non-linear odd function to the disturbance signal, the combiner generates a corrected position error signal by summing the position error signal and the correction signal, the corrected position error signal has less of the position error than the position error signal has and the transducer is positioned relative to the disk by the corrected position error signal.

71. (New) The disk drive of claim 70, wherein the attenuator includes a saturation controller that clips the correction signal if the amplitude of the correction signal is above a threshold.

72. (New) The disk drive of claim 70, wherein the attenuator includes a deadzone controller that blocks the correction signal if the amplitude of the correction signal is below a threshold.

73. (New) The disk drive of claim 70, wherein the attenuator generates the correction signal in response to the servo controller entering on-track mode.

74. (New) The disk drive of claim 70, wherein the function is a 5^{th} order function.

75. (New) The disk drive of claim 70, wherein the function is a cubic function.

76. (New) The disk drive of claim 75, wherein the function is:

$$f(u) = M\left(\frac{u}{N}\right)^3$$

N represents a threshold level for non-linear signal adjustment;

M represents a signal adjustment factor; and

u represents the amplitude of the disturbance signal.

77. (New) The disk drive of claim 70, wherein the disturbance is a random disturbance.

78. (New) The disk drive of claim 77, wherein the random disturbance is non-repeatable run out.

79. (New) The disk drive of claim 78, wherein the non-repeatable run out is due to a rocking mode excited by a spindle motor bearing.

80. (New) A disk drive comprising:

a disk;

a transducer for reading from and writing to the disk;

a servo controller that generates a position error signal that includes a disturbance signal, wherein the disturbance signal is due to a disturbance and causes a position error in the position error signal; and

an attenuator that includes a peak filter, a gain controller and a combiner, wherein the peak filter generates the disturbance signal by narrow-band filtering the position error signal based on the frequency band and amplitude range of the disturbance signal, the gain controller generates a correction signal by applying a non-linear function to the disturbance signal, the combiner generates a corrected position error signal by summing the position error signal and the correction signal, the corrected position error signal has less of the position error than the position error signal has and the transducer is positioned relative to the disk by the corrected position error signal.

81. (New) The disk drive of claim 80, wherein the attenuator includes a saturation controller that clips the correction signal if the amplitude of the correction signal is above a threshold.

82. (New) The disk drive of claim 80, wherein the attenuator includes a deadzone controller that blocks the correction signal if the amplitude of the correction signal is below a threshold.

83. (New) The disk drive of claim 80, wherein the attenuator generates the correction signal in response to the servo controller entering on-track mode.

84. (New) The disk drive of claim 80, wherein the function is an odd function.

85. (New) The disk drive of claim 84, wherein the function is a cubic function.

86. (New) The disk drive of claim 85, wherein the function is:

$$f(u) = M\left(\frac{u}{N}\right)^3$$

N represents a threshold level for non-linear signal adjustment;

M represents a signal adjustment factor; and

u represents the amplitude of the disturbance signal.

87. (New) The disk drive of claim 80, wherein the disturbance is a random disturbance.

88. (New) The disk drive of claim 87, wherein the random disturbance is non-repeatable run out.

89. (New) The disk drive of claim 88, wherein the non-repeatable run out is due to a rocking mode excited by a spindle motor bearing.

90. (New) A disk drive comprising:

a disk;

a transducer for reading from and writing to the disk;

a servo controller that generates a position error signal that includes a disturbance signal, wherein the disturbance signal is due to a disturbance and causes a position error in the position error signal; and

an attenuator that includes a band pass filter, a gain controller, a saturation controller and a combiner, wherein the band pass filter generates the disturbance signal by narrow-band filtering the position error signal, the gain controller generates a correction signal by applying a non-linear function to the disturbance signal, the saturation controller clips the correction signal if the amplitude of the correction signal is above a threshold, the combiner generates a corrected position error signal by summing the position error signal and the correction signal, the corrected position error signal has less of the position error than the position error signal has and the transducer is positioned relative to the disk by the corrected position error signal.

91. (New) The disk drive of claim 90, wherein the saturation controller is between the band pass filter and the gain controller.

92. (New) The disk drive of claim 90, wherein the saturation controller is between the gain controller and the combiner.

93. (New) The disk drive of claim 90, wherein the attenuator generates the correction signal in response to the servo controller entering on-track mode.

94. (New) The disk drive of claim 90, wherein the function is an odd function.

95. (New) The disk drive of claim 94, wherein the function is a cubic function.

96. (New) The disk drive of claim 95, wherein the function is:

$$f(u) = M\left(\frac{u}{N}\right)^3$$

N represents a threshold level for non-linear signal adjustment;

M represents a signal adjustment factor; and

u represents the amplitude of the disturbance signal.

97. (New) The disk drive of claim 90, wherein the disturbance is a random disturbance.

98. (New) The disk drive of claim 97, wherein the random disturbance is non-repeatable run out.

99. (New) The disk drive of claim 98, wherein the non-repeatable run out is due to a rocking mode excited by a spindle motor bearing.

100. (New) A disk drive comprising:

a disk;

a transducer for reading from and writing to the disk;

a servo controller that generates a position error signal that includes a disturbance signal, wherein the disturbance signal is due to a disturbance and causes a position error in the position error signal; and

an attenuator that includes a band pass filter, a gain controller, a deadzone controller and a combiner, wherein the band pass filter generates the disturbance signal by narrow-band filtering the position error signal, the gain controller generates a correction signal by applying a non-linear function to the disturbance signal, the deadzone controller blocks the correction signal if the amplitude of the correction signal is below a threshold, the combiner generates a corrected position error signal by summing the position error signal and the correction signal, the corrected position error signal has less of the position error than the position error signal has and the transducer is positioned relative to the disk by the corrected position error signal.

101. (New) The disk drive of claim 100, wherein the deadzone controller is between the band pass filter and the gain controller.

102. (New) The disk drive of claim 100, wherein the deadzone controller is between the gain controller and the combiner.

103. (New) The disk drive of claim 100, wherein the attenuator generates the correction signal in response to the servo controller entering on-track mode.

104. (New) The disk drive of claim 100, wherein the function is an odd function.

105. (New) The disk drive of claim 104, wherein the function is a cubic function.

106. (New) The disk drive of claim 105, wherein the function is:

$$f(u) = M\left(\frac{u}{N}\right)^3$$

N represents a threshold level for non-linear signal adjustment;

M represents a signal adjustment factor; and

u represents the amplitude of the disturbance signal.

107. (New) The disk drive of claim 100, wherein the disturbance is a random disturbance.

108. (New) The disk drive of claim 107, wherein the random disturbance is non-repeatable run out.

109. (New) The disk drive of claim 108, wherein the non-repeatable run out is due to a rocking mode excited by a spindle motor bearing.